Trend Study 17-21-97

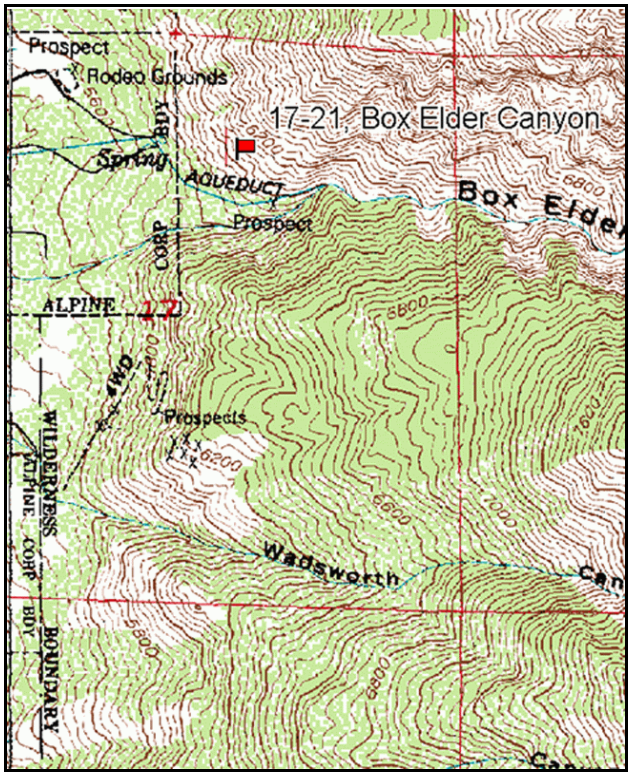
Study site name: Box Elder Canyon. Vegetation type: Mountain Brush.

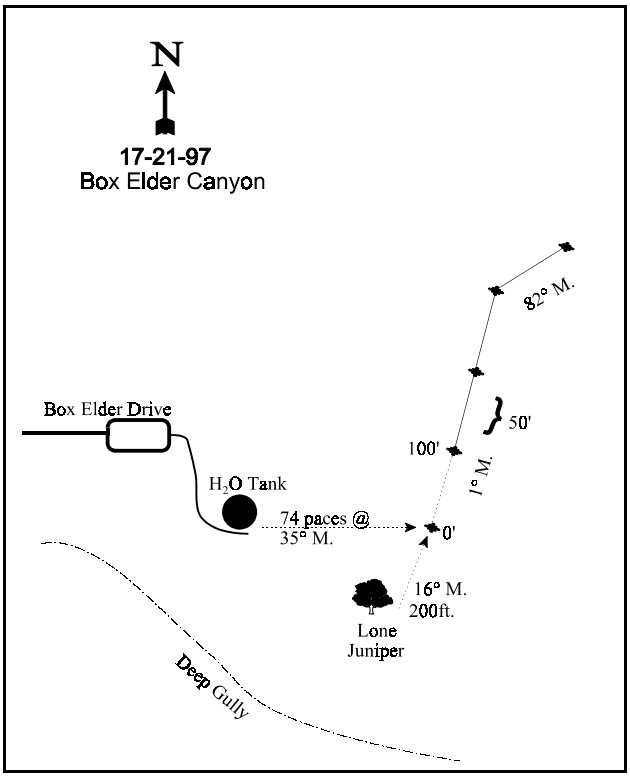
Compass bearing: frequency baseline 1 degrees magnetic (line 4 @ 82°M).

Frequency belt placement: line 1 (11 & 95), line 2 (34ft), line 3 (59ft), line 4 (71ft).

LOCATION DESCRIPTION

From Alpine, proceed northeast to the road which runs up Box Elder Canyon. Proceed up Box Elder Canyon until you come to a cement spring water collection structure, on the north side of the road. From the collection system, proceed 0.15 miles to the east, to an aqueduct breather pipe on the south side of the road. From the breather pipe, walk 74 paces at an azimuth of 35 degrees magnetic to a lone Utah juniper on the hillside. From the juniper, the 0-foot baseline stake is 200 feet away at an azimuth of 16 degrees magnetic. The study is marked by green steel "T" fenceposts approximately 12 to 18 inches in height. The 0-foot baseline stake has a red browse tag, # 3811, attached.





Map Name: Timpanogos Cave

Township 4S, Range 2E, Section 17

Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4480673 N 437082 E

DISCUSSION

Box Elder Canyon - Trend Study No. 17-21

***SUSPENDED - This site was suspended in 2002.

This study has in the past been thought of as critical deer winter range located at the mouth of Box Elder Canyon. It has an elevation of 6,700 feet and lies on a steep (60-65%) south to southwest slope. Like other similar sites along the Wasatch Front, the plant community is highly variable. Patches of Gambel oak, curlleaf mountain mahogany, and true mountain mahogany are separated by larger openings dominated by annual and perennial grasses and broad-leafed weeds. Utilization of the browse species was reportedly high in the past, but recent data indicates a drop in utilization. Pellet groups were low with some wildlife bedding areas noted in 1997.

For such a steep slope, soil conditions are remarkably good. Soil and rock movement downslope is occurring, but not at an accelerated rate. Soil is shallow and extremely rocky with a limestone parent material. Soil textural analysis indicates a loam with a neutral pH of 7.2. Phosphorous may be limiting in the soil. Effective rooting depth is estimated at 16 inches, although most of the deeper soil is found were cracks occur in the rocks below the soil surface. Litter and vegetative cover are adequate to prevent serious soil loss.

Gambel oak is the dominate browse species and occurs as low-growing clumps or patches with an average height for mature plants of 35 inches. In 1983, heavy hedging was reported on this mostly mature population. In 1989 hedging was reported as light with only 25% of the population classified as mature. In 1997 hedging was reported as light, but now the population is classified as mostly mature. A combination of heavy hedging and some insect and disease damage has adversely affected vigor in the past. Vigor was excellent in 1997.

True mountain mahogany is also present on the site. As with Gambel oak, hedging intensity has declined since the initial classification in 1983. In 1997 all plants encountered were classified as mature with good vigor. Broom snakeweed density has declined since 1989 to 1,220 plants/acre. No plants were encountered in 1983. This is a mature population with very few young and no seedlings reported in 1997. Other browse includes small numbers of stickyleaf low rabbitbrush, isolated junipers, curlleaf mountain mahogany, and remnant plants of basin big sagebrush.

Grasses are most abundant in the shrub interspaces. Along with forbs, they are quite rare under the oak canopy. Perennial grasses are perhaps more abundant on this site than on many comparable areas. They provide a measurable amount of forage and are also important for soil retention. Bluebunch wheatgrass comprises the bulk of grass cover with annual grasses such as cheatgrass and rattlesnake brome present, but not overly abundant.

Forb composition is much less favorable than that of grasses. Most forbs are undesirable invader or increaser species. These include ragweed, storksbill, Canada thistle, and spurge. Perennials and biennials include Louisiana sage, spreading fleabane, milkweed, yellow salsify, and false aster.

1983 APPARENT TREND ASSESSMENT

In spite of a very steep slope, soil appears stable. However, the site is fragile and potentially erodible. If ground cover were to be depleted, serious erosion would follow. Vegetatively, Gambel oakbrush will likely continue as the dominant browse. Curlleaf and true mountain mahogany occur frequently and are heavily hedged. Their trend is difficult to predict. Basin big sagebrush has been nearly eliminated and is unlikely to recover. Grass composition and density is above average and should be maintained for watershed protection purposes. Forb composition, from a forage quality standpoint, is poor.

1989 TREND ASSESSMENT

The soil trend is slightly downward. Rock and pavement cover increased with a concurrent decline in vegetative and litter cover. This mountain brush site maintains a stable vegetative trend. The data show only slight changes since the 1983 reading. There is less hedging on the young population in 1989 than in 1983. True mountain mahogany has a low density and a stable population. Forb occurrence is lower in 1989 than in 1983, but this is probably related more to the drought conditions and a mid-September reread date than to declines in the generally weedy species.

TREND ASSESSMENT
soil - down slightly (2)
browse - stable (3)
herbaceous understory - stable, poor forb component (3)

1997 TREND ASSESSMENT

The soil trend is stable with no accelerated erosion present. Vegetative and litter cover are adequate to reduce erosion. Soil and rocks are accumulating on the uphill side of the shrubs and trees. The browse trend is also stable. The Gambel oak population does not appear to be expanding at this time. Hedging for all species is light and vigor is good. Grasses and forbs have changed very little since 1983. Bluebunch wheatgrass is the dominate grass with some annual species present. Forbs are sparse with most classified as invader or increaser species. Herbaceous understory trend is stable with a poor forb component.

TREND ASSESSMENT
soil - stable (3)
browse - stable (3)
herbaceous understory - stable, poor forb component (3)

HERBACEOUS TRENDS --
Herd unit 17 , Study no: 21

Type	Species	Nested Frequency			Quadrat Frequency			Average Cover %
		'83	'89	'97	'83	'89	'97	'97
G	Agropyron elongatum	b14	a-	a-	7	-	-	-
G	Agropyron spicatum	a127	c176	b132	49	69	55	3.84
G	Bromus brizaeformis (a)	-	-	118	-	-	43	.93
G	Bromus japonicus (a)	-	-	95	-	-	34	.63
G	Bromus tectorum (a)	-	-	179	-	-	68	.88
G	Poa pratensis	-	2	-	-	1	-	-
G	Poa secunda	22	12	16	9	5	6	.11
G	Stipa comata	20	36	23	7	17	10	.97
Total for Annual Grasses		0	0	392	0	0	145	2.45
Total for Perennial Grasses		183	226	171	72	92	71	4.93
Total for Grasses		183	226	563	72	92	216	7.38
F	Alyssum alyssoides (a)	-	-	256	-	-	84	2.00
F	Allium spp.	-	-	2	-	-	1	.00
F	Ambrosia psilostachya	a-	b8	b11	-	4	6	.15
F	Arabis drummondi	-	-	3	-	-	1	.00

Type	Species	Nested Frequency			Quadrat Frequency			Average Cover %
		'83	'89	'97	'83	'89	'97	'97
F	Artemisia ludoviciana	$_{b}$87	$_{b}$63	$_{a}$28	37	30	13	.88
F	Asclepias labriformis	4	1	3	3	1	2	.03
F	Cirsium arvense	14	4	-	8	4	-	-
F	Descurainia pinnata (a)	-	-	7	-	-	3	.02
F	Epilobium brachycarpum (a)	-	-	1	-	-	1	.01
F	Erodium cicutarium (a)	-	-	3	-	-	1	.00
F	Erigeron divergens	$_{b}$34	$_{a}$3	$_{a}$13	15	1	6	.22
F	Euphorbia spp.	2	-	-	1	-	-	-
F	Galium aparine (a)	-	-	28	-	-	12	.24
F	Hackelia patens	9	2	3	4	1	2	.15
F	Lygodesmia grandiflora	-	-	1	-	-	1	.00
F	Machaeranthera canescens	3	3	3	1	1	1	.03
F	Microseris nutans	8	3	-	3	2	-	-
F	Oenothera spp.	-	-	8	-	-	3	.09
F	Phlox longifolia	-	1	-	-	1	-	-
F	Stellaria jamesiana	-	-	1	-	-	1	.00
F	Tragopogon dubius	19	4	7	9	3	4	.04
F	Unknown forb-annual (a)	-	-	20	-	-	10	.26
F	Vicia americana	-	2	-	-	1	-	-
Total for Annual Forbs		0	0	315	0	0	111	2.55
Total for Perennial Forbs		180	94	83	81	49	41	1.64
Total for Forbs		180	94	398	81	49	152	4.20

Values with different subscript letters are significantly different at alpha = 0.10 (annuals excluded)

BROWSE TRENDS --
Herd unit 17 , Study no: 21

Type	Species	Strip Frequency	Average Cover %
		'97	'97
B	Cercocarpus ledifolius	0	.03
B	Cercocarpus montanus	15	5.80
B	Gutierrezia sarothrae	30	1.03
B	Quercus gambelii	36	11.59
Total for Browse		81	18.46

CANOPY COVER --
Herd unit 17 , Study no: 21

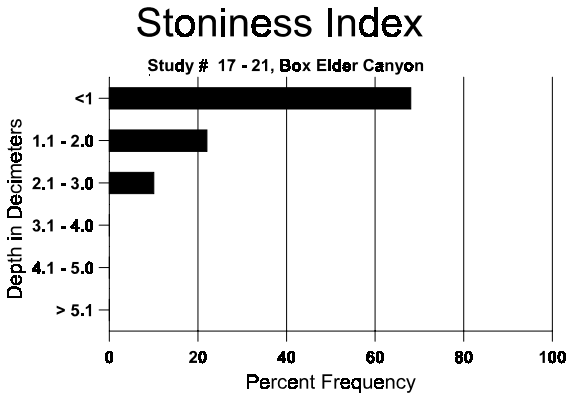
Species	Percent Cover '97
Juniperus osteosperma	.6
Quercus gambelii	1.4

BASIC COVER --
Herd unit 17 , Study no: 21

Cover Type	Nested Frequency '97	Average Cover % '83	'89	'97
Vegetation	335	6.00	3.50	27.98
Rock	243	13.25	19.00	16.49
Pavement	226	6.00	16.00	7.09
Litter	393	68.75	56.75	42.16
Cryptogams	19	1.50	.25	.12
Bare Ground	229	4.50	4.50	14.78

SOIL ANALYSIS DATA --
Herd Unit 17, Study no: 21, Box Elder Canyon

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	dS/m
16.1	57.36 (16.0)	7.2	46.0	29.1	24.9	2.9	6.0	76.8	.6



PELLET GROUP FREQUENCY --
Herd unit 17 , Study no: 21

Type	Quadrat Frequency '97
Rabbit	1
Elk	10
Deer	9

BROWSE CHARACTERISTICS --
Herd unit 17 , Study no: 21

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Cercocarpus ledifolius																		
M	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	89	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0	106	109	0

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'83	00%	00%	00%	
'89	00%	00%	00%	
'97	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'83	0	Dec:	-
	'89	0		-
	'97	0		-

Cercocarpus montanus																		
Y	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	89	-	-	1	-	-	-	-	-	-	1	-	-	-	33			1
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
M	83	-	2	5	-	-	-	-	-	-	4	1	2	-	233	46	39	7
	89	1	4	-	-	2	-	-	-	-	7	-	-	-	233	43	53	7
	97	10	5	1	-	3	-	-	-	-	19	-	-	-	380	65	73	19

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'83	29%	71%	29%	+12%
'89	75%	13%	00%	+30%
'97	42%	05%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'83	233	Dec:	-
	'89	266		-
	'97	380		-

Chrysothamnus viscidiflorus lanceolatus																		
M	83	1	-	-	-	-	-	-	-	-	1	-	-	-	33	13	20	1
	89	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'83	00%	00%	00%	
'89	00%	00%	00%	
'97	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'83	33	Dec:	-
	'89	0		-
	'97	0		-

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Gutierrezia sarothrae																		
S	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	89	3	-	-	-	-	-	-	-	-	3	-	-	-	100			3
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
Y	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	89	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	97	3	-	-	-	-	-	-	-	-	3	-	-	-	60			3
M	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	89	42	-	-	-	-	-	-	-	-	42	-	-	-	1400	10	13	42
	97	58	-	-	-	-	-	-	-	-	58	-	-	-	1160	12	14	58
D	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	89	12	-	-	-	-	-	-	-	-	9	-	-	3	400			12
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'83	00%	00%	00%	
'89	00%	00%	06%	-32%
'97	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'83	0	Dec:	0%
	'89	1800		22%
	'97	1220		0%

Juniperus osteosperma																		
M	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	89	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0	16	10	0
X	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	89	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	20			1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'83	00%	00%	00%	
'89	00%	00%	00%	
'97	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'83	0	Dec:	-
	'89	0		-
	'97	0		-

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Quercus gambelii																		
S	83	2	-	-	-	-	-	-	-	-	-	2	-	-	66			2
	89	13	-	-	1	-	-	-	-	-	14	-	-	-	466			14
	97	6	-	-	-	-	-	-	-	-	6	-	-	-	120			6
Y	83	-	5	6	-	-	-	-	-	-	-	5	-	6	366			11
	89	86	-	-	1	-	-	-	-	-	87	-	-	-	2900			87
	97	36	-	-	-	-	-	-	-	-	36	-	-	-	720			36
M	83	-	12	51	-	-	-	-	-	-	12	26	-	25	2100	31	23	63
	89	34	-	-	-	-	-	-	-	-	34	-	-	-	1133	32	16	34
	97	99	38	-	-	1	-	-	-	-	138	-	-	-	2760	35	43	138
D	83	-	-	2	-	-	-	-	-	-	-	-	-	2	66			2
	89	10	4	-	1	-	-	-	-	-	7	-	7	1	500			15
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
X	83	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	89	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	97	-	-	-	-	-	-	-	-	-	-	-	-	-	80			4

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'83	22%	78%	43%	+44%
'89	03%	00%	06%	-23%
'97	22%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'83	2532	Dec:	3%
	'89	4533		11%
	'97	3480		0%